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SOLAR FLIGHT ON MARS AND VENUS

Geoffrey A. Landis
NASA John Glenn Research Center
Mailstop 302-1
Cleveland, OH 44135

Christopher LaMarre
University of Illinois

Anthony Colozza
Analex
NASA John Glenn Research Center

Solar powered aircraft are of interest for exploring both Mars and Venus.

The thin atmosphere of Mars presents a difficult environment for flying. It is clear that a new approach is needed. By making a totally solar airplane, we can eliminate many of the heavy components, and make an airplane that can fly without fuel. Using high efficiency solar cells, we can succeed with an airplane design that can fly for up to 6 hours in near-equatorial regions of Mars (4 hours of level flight, plus two hours of slow descent), and potentially fly for many days in the polar regions. Bu designing an airplane for a single day flight. In particular, this change means that we no longer have to cope with the weight of the energy storage system that made previous solar powered airplanes for Mars impractical). The new airplane concept is designed to fly only under the optimal conditions: near equatorial flight, at the subsolar point, near noon. We baseline an 8 kg airplane, with 2 kg margin. Science instruments will be selected with the primary criterion of low mass.

Solar-powered aircraft are also quite interesting for the exploration of Venus. Venus provides several advantages for flying a solar-powered aircraft. At the top of the cloud level, the solar intensity is comparable to or greater than terrestrial solar intensities. The atmospheric pressure makes flight much easier than on planets such as Mars. Figure 1 shows the atmospheric pressure on Venus. From an altitude of approximately 45 km (pressure = 2 bar), to approximately 60 km (pressure = 0.2 bar), terrestrial airplane experience can be easily applied to a Venus airplane design. At these flight altitudes, the temperature varies from 80 °C at 45 km, decreasing to –35 °C at 60 km. Also, the slow rotation of Venus allows an airplane to be designed for flight within continuous sunlight, eliminating the need for energy storage for nighttime flight. These factors make Venus a prime choice for a long-duration solar-powered aircraft.

Fleets of solar-powered aircraft could provide an architecture for efficient and low-cost comprehensive coverage for a variety of scientific missions. Exploratory planetary mapping and atmospheric sampling can lead to a greater understanding of the greenhouse effect not only on Venus but on Earth as well.

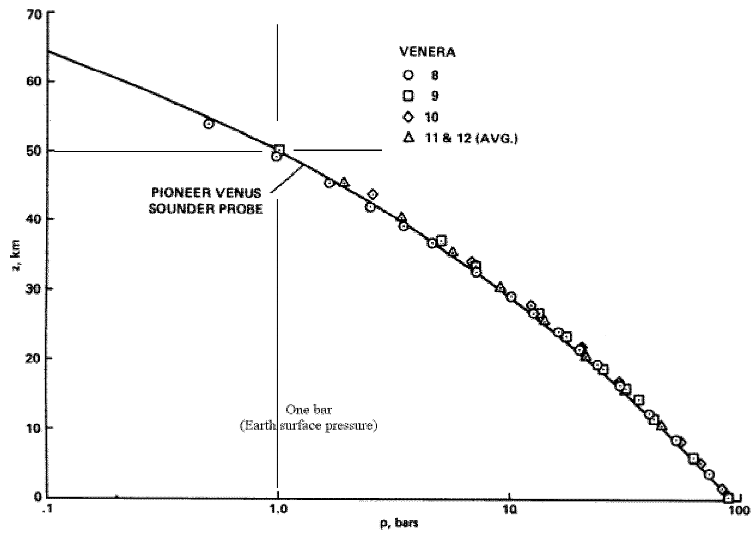

Figure 1. Atmospheric pressure (horizontal axis) as a function of altitude (vertical axis) in the Venus atmosphere. (Data from Venera 8-12 and Pioneer Venus missions).

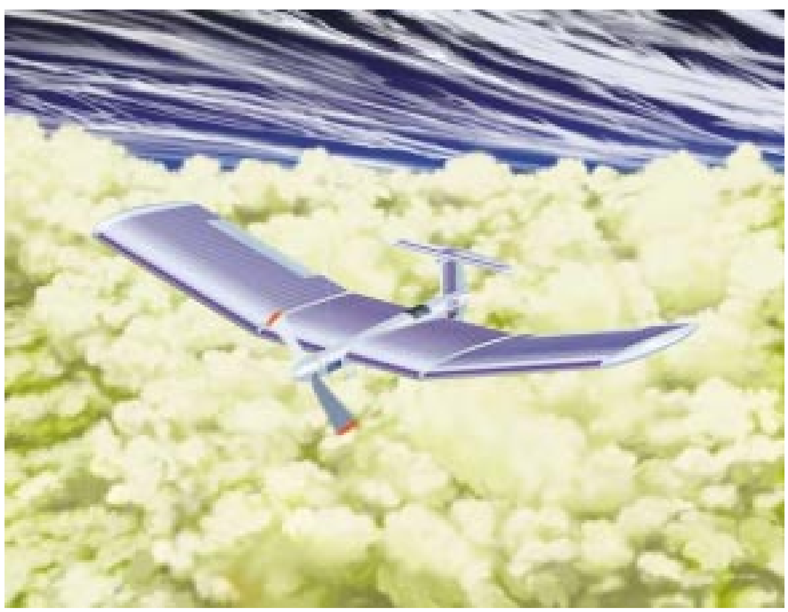

Figure 2. Concept for a Venus airplane design

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